

ment of the rectum. Hepatic organ the same. Organs of generation double, occupying the middle part of the body; their form undetermined. *Ocelli* at some distance from the head, of the same colour as in *U. infrequens*.

*Size.* 1-7th of an inch long and 1-600th of an inch broad.

*Male.* The same as the female, but with a large, thick, curved tail, obtuse at the extremity, tuberculated in its inner curvature, and furnished on each side with a row of short setæ extending from above the anus towards the tip; also three or four setæ on the outer curvature. Testis and penis the same as in the foregoing species; form of the testis undetermined.

*Hab.* Same.

*Loc.* Island of Bombay.

*Urolabes parasitica*, n. sp.

*Female.* Linear, cylindrical, unstriated, gradually diminishing towards the head, which is obtuse and without papillæ, and also towards the tail, which is long and conical. Mouth and anus as in the foregoing species. Vulva a little in front of the middle of the body.

Alimentary canal and hepatic organ the same. Œsophagus commencing in an expanded oral orifice, immediately becoming narrowed into a straight uniform tube; naked at the commencement, but soon surrounded by a sheath, which goes on increasing in width to the point of union of the œsophagus and intestine, after which it continues of uniform calibre to the termination of the latter. Organs of generation double, occupying the middle third of the body, their form undetermined; filled with ova diminishing in size with their distance from the vulva, and all presenting the germinal vesicle.

*Size.* 1-43rd of an inch long.

*Male.* Unseen.

*Hab.* Peritoneal cavity of *Nais albida*, in more or less abundance during the "rains," when this *Nais* makes its appearance in the *Glæocapsa* mentioned.

*Loc.* Island of Bombay\*.

[To be continued.]

IV.—On the occurrence of a Fish (Pteraspis) in the Lower Ludlow Rock. By J. W. SALTER, F.G.S.

THE discovery of a true Fish in beds of the Silurian system considerably older than the famous "bone-bed" of the Upper Ludlow rocks is a fact of much interest. It is desirable at once

\* For a small figure of this worm, see 'Annals,' series 3, vol. ii. pl. 4. fig. 50.

to make it known, the more so as *all* previously-described fishes from the Silurian system, other than those of the very topmost layer (the bone-bed), have, when carefully examined, turned out to be something else than fish. Zoophytes, Trilobite-fragments, plates of Cystidean animals, the tail-spines of Crustacea, even worm-burrows and scales of black mica, have all been mistaken for fragments of fish-bones or scales, and have some of them figured even in general works. The only undoubted specimen (a fish-palate) was described from rocks of the age of the Dudley limestone; but this has proved to be a Carboniferous species\*, and was most probably introduced by accident into the quarry of older rock, among the debris of which it was picked up.

It is therefore a matter of real interest to find at length a true Vertebrate down in the mud-stones of the Lower Ludlow rock, many hundred feet below the bone-bed. The position of the fossil is unquestionable; its place has been determined by one of the most persevering of our local geologists, Mr. Lightbody of Ludlow, who (in company with Mr. Lee of Caerleon) found it, and in whose collection the gem remains; and it has been verified by others, the Rev. W. Symonds of Pendock especially, who, as well as myself, has seen the quarry, and knows well that these flat-bedded strata belong to the Lower Ludlow, are full of the characteristic fossils, and are regularly surmounted by the Aymestry limestone and the Upper Ludlow rock.

The place of the fossil thus secure, its structure is the next point of importance; and those who have read the memoir on *Pteraspis* in a late volume of the 'Quarterly Geological Journal †' will be satisfied with the statement that both the prismatic inner or second layer, and a good deal of the outer striated layer, are preserved on this nearly complete dermal plate—the portion usually preserved, and which was shown, at the last Meeting of the British Association ‡, to lie immediately behind the head, on the dorsal surface.

*Description.*—This nuchal plate shows a very similar form and striation to that of *Pteraspis truncatus* § from the topmost layers of the Ludlow rock (or Downton sandstone), but it is longer and narrower, and of much less depth and convexity. This is not due to pressure; for an Upper Ludlow specimen, undistorted, has the same characters. The general form is a long oval, with the ends truncated; the front is slightly emar-

\* *Cochliodus aliformis*, M'Coy. See Quarterly Geol. Journal, vol. vii. p. 266. figs. a, b, c.

† Prof. Huxley, in vol. xiv. p. 267, &c.

‡ *Id.* in Rep. Brit. Assoc. for 1858, Trans. Sect. p. 82.

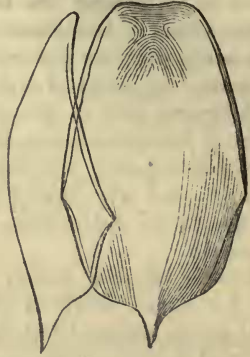
§ See Banks in Quart. Geol. Journ. vol. xii. pl. 2. f. 1.

ginate; the posterior end (not perfect in fig 1, but nearly so in the Upper Ludlow specimen\*) has an obtuse short keel, but is

Fig. 1.

*P. ludensis.*

Fig. 2.

*P. truncatus.*

Outline-diagrams of *Pteraspis*. The figures are not strict drawings, but intended to point out the distinguishing characters of the two species.

not prolonged, to all appearance, into a spine, as in *P. truncatus*; nor is the posterior margin nearly so oblique. The fragment is sufficiently perfect to show this. The lateral angle *a*, which terminates the bevelled sutural edge *b*, is further back in the new species.

Besides the narrower form, there is a decided difference in the direction of the sculpturing. In *P. truncatus* (fig. 2) the striæ and also the stronger intermediate ribs converge posteriorly towards the ridge and spine, and again anteriorly towards an obscure median line. In this species, on the other hand, they start more parallel from the posterior margin, and near the anterior end diverge towards the outer angles. So far as the preservation of the specimen permits of judging, there are no stronger striæ anteriorly.

As there seem to be sufficient characters to distinguish the species, it will be well not to confound it with *P. truncatus*, to which it was doubtfully referred in the second edition of 'Siluria †.' It may be called

*P. ludensis*, n. sp.

*P. scuto nuchali elongato, oblongo-ovali, convexo nec gibbo, antice truncato etiam emarginato, postice brevicarinato haud longispi-*

\* It is added in dotted outline to fig. 1.

† Page 267. It is mentioned as probably distinct, in the note on *Pteraspis* appended to Mr. R. Banks's paper, before quoted. This referred only to the Upper Ludlow specimen with an incomplete surface.

noso; superficie lineis subrectis antice divergentibus tenuissime striata.

*Localities.* Lower Ludlow Rock, Leintwardine, with shells, star-fish, and large species of *Pterygotus* (fig. 1, Mr. Lightbody's Collection; found in 1859). Upper Ludlow Rock, Ludlow (in Mr. J. Harley's Collection, found in 1852).

Of the true piscine nature of the species just described we have clear evidence in the existence of all the three layers of bone described by Prof. Huxley in his memoir. With regard to the *P. truncatus*, which is less perfectly preserved, the inner layer has not yet been observed; but in the structure and ornament of the two outer ones—the general form, lateral angles, and bevelled sutural edges—there is the closest resemblance to *P. ludensis*. The Crustaceans of the same rocks have a different ornament, and, it is needless to say, no bony structure.

What the relative standing of these very ancient Cephalaspid fish may be, is a point yet to be decided; but it is at least worthy of note that the range of fishes a little further backward in time is established by the discovery, not of new types, but of new species of a genus and group proper to the lowest beds of the overlying formation, and characteristic of these beds. In the same way, the giant *Pterygoti*, long known in the Old Red Sandstone, have now been traced downward in diminishing numbers, and of new species, through all the Upper Silurian beds. Again, a Pteropod and a Cystidean have been disinterred from the "primordial zone" (the *Lingula* flags); but these are of genera familiar to us in the true Lower Silurian rocks. Annelida, and perhaps Trilobites, recede further back than the base of the Silurian; but, as yet, the Cambrian has yielded no other new and unexpected types, and, save a doubtful Zoophyte or Polyzoon, no other forms at all. And if we turn to the highest of the palæozoic groups, the reptiles which have at length been discovered in the Coal are found to belong to the lower forms with which we have become acquainted in the Permian and Trias; or, where they differ from these, it is to present indications of even a still lower grade\*. It is impossible to help surmising, however unphilosophical it may appear to some, that we may not be very far from the downward limit of one at least of the zoological subkingdoms. If, indeed, we discovered a Brachyurous crab, or a single reptile of high organization in Silurian rocks,—a mammal in the Old Red, or a fish in the primordial zone, such a fact would go far to demolish the supposition. But the gradual tracing back of types a little only beyond their previous limits does not appear calcu-

\* Owen, in 'Siluria,' 2nd edition, p. 363.



lated to shake the generally received opinion of a progressive organization of animals during geological time, the lower preceding the higher.

But can the same be said for plants? Coniferæ are among the most rife in the earliest strata in which land plants abound, and these are reckoned, by some of our best botanists, the highest types of plants! Dicotyledons succeed; and Monocotyledons, the least complex of the flowering plants, scarcely appear till Tertiary times. Has there been an inverse order of creation for plants, compared with that of animals? Is it true that Palms and Bananas are inferior to the Cypress and the Fir-tree?

V.—*Notes on the Hydroid Zoophytes.* By Prof. ALLMAN.

I. *Tubularia indivisa*.

THE reproductive sacs of *Tubularia indivisa*, though never destined to become free, and belonging to the type of *sporosacs* rather than *Medusæ*, present nevertheless a structure in which a true medusoid type may be fully recognized, and are thus of especial interest in establishing the exact relation between *sporosacs* and *Medusæ*, the two forms of bodies in one or other of which the generative elements of the marine Hydroid Zoophytes always originate.

Included within an external investment, or *ectothèque*, in which thread-cells are imbedded, is a second sac, having a well-defined opening near its summit. A circular canal, rendered evident by the red pigment-granules it contains, surrounds this opening. Four longitudinal canals open symmetrically into the circular canal, and thence, running along the inner side of the walls of the sac, enter the base of a large manubrium\*, which extends through the axis of the sac.

Between the endoderm and ectoderm of the manubrium the generative elements (ova or spermatozoa) are developed, and when sufficiently mature escape, after the rupture or absorption of the confining ectoderm, through the opening in the sac just described, the *ectothèque* giving way before them, apparently by rupture.

It is impossible not to see here, in the sac which lies immediately within the *ectothèque*, the umbrella of a *Medusa*, with its orifice and its circular and radiating canals; so that in this highly interesting form of *sporosac* we have, with a closed manubrium, all the parts amply represented which are found in

\* The diverticulum from the *cœnosarc* which extends through the axis of the *sporosac*, or forms the so-called peduncle of the *Medusa*.